

CENTURY HISTORY

FROM SANDBAGS TO MAAS: AIRCRAFT ARRESTING SYSTEMS

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Aircraft arresting systems have become one of the most critical operational responsibilities for Air Force engineers. In emergency situations, a system has only seconds to react, stop an aircraft safely, and save the lives of the crew.

The history of arresting systems goes back to 1911, when a pilot, Eugene Ely, landed a Curtiss Military Type III biplane on the deck of the USS Pennsylvania. His arresting gear was a couple of sandbags tied to a length of rope stretched across the deck. From that one landing, successively more complicated systems have developed.

In a test of the MA-1A landing barrier by a USAF F-86, at a base in Japan, the camera shows the fighter intercepting, which is moving at about 140 miles per hour, just before it makes contact with the arresting device.

The Air Force first began using barriers during the Korean War as aircraft were being lost when they overran runways on takeoffs and landings. The development of jet aircraft such as the F-80, F-82, F-84, and particularly the F-86 Sabre stretched the limits of Korea's World War II-size runways. Even with the construction of 9,000-foot concrete runways, the problem persisted. Beginning in September 1952, the Air Force devised a successful aircraft arresting barrier.

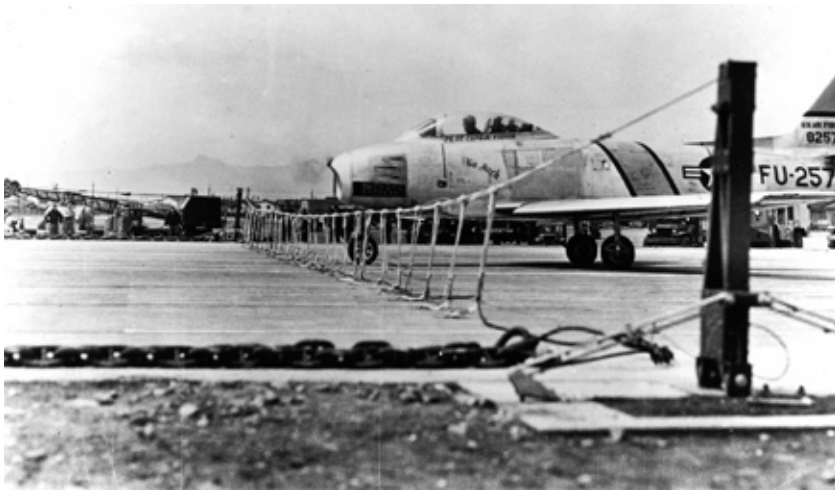
The design was based on the same principle as the barriers used on aircraft carriers. A nylon webbing assembly was stretched across the runway so that, when engaged by the aircraft, it triggered a steel cable which in turn engaged the main landing gear struts. The kinetic energy of the aircraft was absorbed by heavy anchor chain, lying parallel to the runway. The weight of the dragging chain decelerated and finally stopped the aircraft.

Following extensive testing, the Air Force installed the unidirectional barrier, known as MA-1A, at several Korean bases. The inexpensive barriers saved so many expensive aircraft that the Air Force adopted them for use at all of its fighter bases.

As the Air Force developed heavier and faster aircraft, the anchor chain was no longer adequate as an energy absorber. The next practical development was the "Water Squeezer" or Barrier Arresting Kit 6 (BAK-6). This bidirectional system for hook-equipped aircraft worked on the hydraulic principle. Two loosely fitting pistons, connected through a short cable, were pulled through a tapered tube which was partially filled with fluid. As the pistons moved toward the smaller end of the fluid-filled section of tube, the resulting hydraulic pressure brought the pistons to a halt.

The energy absorber of the BAK-6 consisted of two arresting tube assemblies, one on each side of the runway. The forward end of the leading piston in each tube was connected to a purchase cable. The free ends of the cables were connected to a pendant that spanned the runway.

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The BAK-6 had several shortcomings: the maintenance of fluids in over 1,400 feet of pipe was difficult, retrieval required a crew of five people and three vehicles following an engagement, and the antifreeze solution required periodic recirculation to prevent stratification during cold weather.

Designers of the BAK-9 borrowed from several sources for their new system. The BAK-9 contained a rotary friction energy-absorbing engine consisting of two tape storage reels with standard B-52 aircraft disc brakes mounted on a common shaft. The reels were mechanically connected at the mid-point by a third break which acted as a clutch permitting each reel to turn at different speeds during off-center engagements, and helped steer the aircraft toward the center of the runway. When an aircraft's hook engaged the pendant stretched across the runway, hydraulic pressure provided by a pump, which was chain driven by the rotation of the reel and shaft assembly, provided total braking pressure of 2,000 PSIG. Aircraft without hooks were stopped by engagement with an MA-1A barrier pendant utilizing the BAK-9 energy absorbing equipment. The BAK-9 could be retrieved

and serviced by only one person and was more compact than the BAK-6.

The BAK-12 arresting system was a rotary friction energy absorber consisting of two identical units installed on each side of the runway. Special nylon tape was used as the purchase or drive member. The aircraft's arresting hook engaged a cable stretched across the runway, and the energy was absorbed in the rotary friction brakes during tape payout. The BAK-12 could also be used as the energy absorber in installations designed to arrest aircraft that were not equipped with hooks. The BAK-12 could be permanently mounted in a concrete pit. For expeditionary operations, the kit could be flown in, set up, and put in operation in six hours by anchoring it on top of the ground. The BAK-12 has become the standard system for the Air Force.

The BAK-12 was developed just in time for use in Vietnam. As the Air Force introduced jet aircraft into Southeast Asia, engineers installed BAK-9s and BAK-12s at numerous bases. However, many of the kits were improperly installed because of inexperienced installation crews. The Air Force contracted with the Bliss Company (manufacturer of the barrier) to provide technical assistance and PACAF/DE produced detailed drawings and specifications for use by local contractors or untrained personnel responsible for installation. RED HORSE personnel eventually installed and repaired arresting systems at several



An Air Force civil engineer examines an expeditionary BAK-12 aircraft arresting system at Bien Hoa AB, Vietnam, 1965.

Southeast Asian bases. During the Vietnam War, the Air Force averaged more than 1,000 engagements annually at these bases.

The recent development of the mobile aircraft arresting system (MAAS) permits engineers to provide for the rapid deployment of an aircraft recovery system. A self-contained modified BAK-12, the MAAS is easily transportable by air or land and can be installed by a ten-person crew in minutes. After installation in concrete,

asphalt, or soil, the system can handle up to 20 engagements per hour. Both MAAS and BAK-12s were used at bases in Southwest Asia during Operation DESERT STORM.

Over the years, aircraft arresting systems have saved hundreds of lives and aircraft. As the Air Force deploys to bare bases in the future, the installation and maintenance of aircraft arresting systems will remain a critical engineering skill.

Barrier or System?

Although many people use the term “barrier” to describe all aircraft arresting systems, there is an important distinction. An aircraft arresting system is a series of components used to engage an aircraft and absorb the forward momentum of a landing or an aborted takeoff. A system comprises an energy absorber, a barrier, and/or a cable. An aircraft arresting barrier is a device such as webbing material, not dependent on an aircraft hook, used to engage and engage the forward momentum of a landing or an aborted takeoff. A pilot lost his life because he was directed to land on a barrier-equipped runway, when what he was requesting was a runway with an arresting system.